Multi-method comparison of detrital river sediments – a case study from the Pannonian Basin

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The Pannonian Basin is one of the largest sedimentary reservoirs of Europe that presumably contains a great amount of Alpine detritus [1]. Further sources of the basin fill include the Western and Eastern Carpathians as well as the Apuseni Mountains. The sedimentary material is delivered to the basin via numerous rivers, from different source areas resulting in characteristic sedimentary signatures. Our long-term goal is to develop a robust multiparameter method to identify the characteristic features of these river sediments in the basin-fill deltas.

In this study Quaternary sediments of the Drau river (Eastern Alps), Ipoly river (Western Carpathians) and those of the Tisza river (Eastern Carpathians) are compared. These sediments represent the eroded material of a dominantly metamorphic, a magmatic and a mostly sedimentary (reworked) source area, respectively. The applied methods include apatite and zircon fission-track dating (AFT and ZFT) and Raman spectroscopy-based heavy mineral analysis. On the first level of data evaluation the individual AFT and ZFT age components are defined using BayesMix [2]. In the second step, composite low-T thermochronological – heavy mineral data sets are compared with the known lithological composition and cooling age pattern of the different catchment areas.

From the detrital AFT ages Neogene, Paleogene and Cretaceous dates could be isolated in all three rivers. Contrarily, ZFT ages comprise Jurassic and Permian components as well, showing more significant dissimilarities between different rivers. In order to distinguish the three different source areas in a statistically rigorous manner, the combined comparison of AFT, ZFT and heavy mineral data is carried out [3]. These results serve as a basis for tracing the origin of basin-fill sediments.

[1] Kuhlemann, Frisch, Dunkl, Székely (2001), Tectonophysics 330, 1-23.

[2] Jasra et al., (2006) Mathematical Geology 38, 269-300.

[3] Vermeesch (2019) Minerals 9(3), 193.